

## WHAT IS CLAIMED IS:

## 1. A filter circuit, comprising:

an input unit which inputs a signal to be processed;  
a first extraction unit which passes the inputted signal through a filter and which extracts a signal with low-pass characteristics and a signal with band-pass characteristics in the inputted signal; and

a second extraction unit which attenuates a component of the extracted signal with low-pass characteristics and a component of the extracted signal with band-pass characteristics from the inputted signal and which extracts a signal with high-pass characteristics in the inputted signal,

wherein said first extraction unit is comprised of a switched-capacitor equivalent circuit which is to operate a resistor contained in the filter at a predetermined sampling frequency, said sampling frequency is set to a frequency higher than a reproducible frequency of a speaker provided at a subsequent stage, and the filter is so set as to extract the signal with low-pass characteristics and the signal with band-pass characteristics to be cut off by a frequency in the vicinity of the reproducible frequency of a speaker, and

wherein, based on the signal with low-pass characteristics and the signal with band-pass

characteristics, said second extraction unit extracts the signal with high-pass characteristics whose frequency is equal to or higher than the reproducible frequency of a speaker.

2. A filter circuit according to Claim 1, wherein a filter in said first extraction unit is a biquad filter.

3. A filter circuit according to Claim 2, wherein the biquad filter in said first extraction unit includes:

- a first switched-capacitor equivalent circuit which allows passage of the inputted signal;

- a first operation amplifier which extracts the signal with band-pass characteristics from the signal passed through the first switched-capacitor equivalent circuit;

- a second switched-capacitor equivalent circuit which allows passage of the extracted signal with band-pass characteristics;

- a second operation amplifier which extracts the signal with low-pass characteristics from the signal passed through the second switched-capacitor equivalent circuit; and

- a third switched-capacitor equivalent circuit which allows passage of the extracted the signal with low-pass characteristics and feeds back the signal passed therethrough to the first operational amplifier,

- wherein when the first switched-capacitor equivalent

circuit and the second switched-capacitor equivalent circuit invert the phase of the signal passed therethrough, the third switched-capacitor equivalent circuit is so structured as not to invert the phase of the signal passed therethrough; and when the first switched-capacitor equivalent circuit and the second switched-capacitor equivalent circuit do not invert the phase of the signal passed therethrough, the third switched-capacitor equivalent circuit is so structured as to invert the phase of the signal passed therethrough.

4. A filter circuit according to Claim 1, wherein the reproducible frequency of a speaker which is to serve as a reference for the sampling frequency in said first extraction unit is determined according to an enclosure volume of the speaker, and wherein as the enclosure of the speaker becomes smaller, the biquad filter is so set as to raise the frequency at which the signal with low-pass characteristics and the signal with band-pass characteristics are to be cut off.

5. A filter circuit, comprising:

- an input unit which inputs a signal to be processed;
- a first extraction unit which passes the inputted signal through a first-order incomplete integrator and which extracts a signal with low-pass characteristics in the

inputted signal; and

a second extraction unit which attenuates a component of the extracted signal with low-pass characteristics from the inputted signal and which extracts a signal with high-pass characteristics in the inputted signal,

wherein said first extraction unit is comprised of a switched-capacitor equivalent circuit which is to operate a resistor, contained in the first-order incomplete integrator, at a predetermined sampling frequency, said sampling frequency is set to a frequency higher than a reproducible frequency of a speaker provided at a subsequent stage, and the first-order incomplete integrator is so set as to extract the signal with low-pass characteristics to be cut off by a frequency in the vicinity of the reproducible frequency of a speaker, and

wherein, based on the signal with low-pass characteristics, said second extraction unit extracts the signal with high-pass characteristics whose frequency is equal to or higher than the reproducible frequency of a speaker.

6. A filter circuit according to Claim 1, further comprising a control unit which controls the frequency, in the vicinity of the reproducible frequency of a speaker, to be cut off by said first extraction unit.

7. A filter circuit according to Claim 5, further comprising a control unit which controls the frequency, in the vicinity of the reproducible frequency of a speaker, to be cut off by said first extraction unit.

8. A filter circuit according to Claim 6, further comprising:

a receiving unit which receives from a user an instruction on the frequency, in the vicinity of the reproducible frequency of a speaker, to be cut off by said first extraction unit; and

a conversion unit which converts the received instruction into a digital data word,

wherein, based on the digital data word converted, said control unit controls the frequency, in the vicinity of the reproducible frequency of a speaker, to be cut off by said first extraction unit.

9. A filter circuit according to Claim 7, further comprising:

a receiving unit which receives from user an instruction on the frequency, in the vicinity of the reproducible frequency of a speaker, to be cut off by said first extraction unit; and

a conversion unit which converts which converts the received instruction into a digital data word,

wherein, based on the digital data word converted, said control unit controls the frequency, in the vicinity of the reproducible frequency of a speaker, to be cut off by said first extraction unit.

10. A filter circuit including one or more first-order high-pass filters and one or more second-order high-pass filters,

wherein said second-order high-pass filter extracts a signal with low-pass characteristics and a signal with band-pass characteristics and attenuates a component of the extracted signal with low-pass characteristics and a component of the extracted signal with band-pass characteristics so as to extract a signal with high-pass characteristics, and said second-order high-pass filter includes a resistor comprised of a switched-capacitor equivalent circuit which is to operate at a predetermined sampling frequency,

wherein said first-order high-pass filter extracts a signal with high-pass characteristics by a first-order incomplete integrator and attenuates a component of the extracted signal with low-pass characteristics so as to extract a signal with high-pass characteristics, and said first-order high-pass filter is comprised of a switched-capacitor equivalent circuit which is to be operate a resistor, included in the first-order incomplete integrator, at a predetermined sampling frequency, and

wherein the sampling frequency to be set in said one or more first-order high-pass filters and said one or more second-order high-pass filters is set to a frequency higher than a reproducible frequency of a speaker provided at a subsequent stage, and said one or more first-order high-pass filters and said one or more second-order high-pass filters are connected in series and extract the signal with high-pass characteristics whose frequency is equal to or higher than the reproducible frequency of a speaker.

11. A filter circuit according to Claim 10, wherein said second-order high-pass filter includes a biquad filter.

12. A reproduction apparatus, comprising:

- an input unit which inputs a signal to be processed;

- a high-frequency extraction unit which extracts, from the inputted signal, a signal with high-pass characteristics whose frequency is equal to or higher than a reproducible frequency of a speaker provided at a subsequent stage;

- an amplification unit which amplifies the extracted signal with high-pass characteristics; and

- a speaker which reproduces the amplified signal as an audio signal,

- said high-frequency extraction unit including:

- a first extraction unit which passes the inputted signal through a filter and which extracts a signal with

low-pass characteristics and a signal with band-pass characteristics in the inputted signal; and

a second extraction unit which attenuates a component of the extracted signal with low-pass characteristics and a component of the extracted signal with band-pass characteristics from the inputted signal and which extracts a signal with high-pass characteristics in the inputted signal,

wherein the first extraction unit is comprised of a switched-capacitor equivalent circuit which is to operate a resistor contained in the filter is to be operated at a predetermined sampling frequency, said sampling frequency is set to a frequency higher than a reproducible frequency of said speaker, and the filter is so set as to extract the signal with low-pass characteristics and the signal with band-pass characteristics to be cut off by a frequency in the vicinity of the reproducible frequency of said speaker, and

wherein, based on the signal with low-pass characteristics and the signal with band-pass characteristics, the second extraction unit extracts the signal with high-pass characteristics whose frequency is equal to or higher than the reproducible frequency of said speaker.

13. A reproduction apparatus according to Claim 12, wherein



a filter in said first extraction unit is a biquad filter.